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Teacher-Student Relationships in Childhood as a Protective Factor against Adolescent Delinquency up to Age 17: A Propensity Score Matching Approach

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Abstract

In this paper we examined the impact of the quality of teacher-student relationships at age 10 on young people's delinquency at ages 13, 15, and 17 utilizing propensity-score matching. The young people were matched based on 105 characteristics, measured at ages 7 to 10. The sample comprised 1483 (49.4% female) adolescents representing around 80 different countries of origin, residing in Zurich, Switzerland. We found that young people who reported a better relationship with their teacher at age 10, engaged in fewer delinquent acts at ages 13, 15, and 17. These findings suggest that when young people perceive a better relationship with their teachers this serves as a protective factor against their engagement in delinquency up to 7 years later.

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Introduction

Delinquency is a serious societal problem with impact not only on the individual but also on the family, neighborhood, and society at large. Supportive teacher-student relationships have been identified as a protective factor for a range of behavioral problems; less is known about delinquency, particularly in mid to later adolescence. Furthermore, the research thus far is correlational therefore it does not offer insights into a potential causal link between teacher-student relationships and behaviors. In this study, we go some way to fill this gap by reporting findings from a longitudinal study in which we utilized propensity score matching to identify pairs of children with a better versus worse relationship with their teacher but who were otherwise similar on 105 other characteristics. We then compared these matched pairs on their levels of delinquency throughout adolescence. Our findings provide first evidence for the "quasi" causal link between teacher-student relationships and delinquency and thus hold important implications for interventions that may focus on building supportive teacher-student relationships.

Antisocial behavior, including delinquency, in childhood and adolescence has been identified as a major risk factor for a wide range of maladaptive concurrent and later outcomes, including early school drop-out (e.g., Rud et al., 2018), school exclusion (Obsuth et al., 2017), engagement in risky sexual activities and early single parenthood (e.g., Tremblay et al., 2017), and unemployment (e.g., Carter, 2019) as well as continued mental and physical health problems across the lifespan (e.g., Vaughn et al., 2019). Behavior problems have also been identified as one of the most stable of childhood difficulties, especially when their onset is early; prior to age 10. They are often associated with diagnosable disorders, starting with oppositional defiant disorder (ODD), conduct disorder (CD) and serious behavior difficulties, such as delinquency. Early behavior problems have the potential to develop into "expensive disorders" particularly through their links to delinquency and crime (Piquero, 2011).

For several decades now, groups of researchers and theorists from across disciplines, such as criminology and psychology, have highlighted the key role of social relationships to explain a range of human behaviors, including antisocial behavior. The two most prominent theories with relationships at a focal point are Hirschi's (1969) Social Bond Theory in criminology and

Bowlby's (1973) Attachment Theory in psychology. Hirschi's Social Bond Theory, suggests that individuals do not engage in delinquent behavior, when they feel bonded to society through having close emotional ties/attachments formed in social contexts, such as family and school. To this end, the theory highlights the importance of social bonds or "attachments" to significant others, that is those whose opinions and expectations young people care about, for instance parents and teachers (Hirschi, 1969). School has been described as a mirror of society, in which teachers play a key role in transferring societal norms about prosocial behaviors. Much like parents at home, teachers become important role models of conventional societal norms. Thus, according to Social Bond Theory, individuals are not likely to engage in delinquent behavior if they feel close to and are sensitive to the feelings and norms held by their role models, such as their teachers (Thornberry et al., 1991) as they do not want to risk losing them (Jenkins, 1995). An important tenet of the theory is that these social bonds can indirectly impact on our behavior; they do not need to be directly present in order to exert influence (Pratt et al., 2011). This means that attachments that young people form with teachers during late childhood or early adolescence, and the importance and values they place on these relationships may impact on whether they commit delinquent acts later on in their development. This highlights the importance of examining the impact of student-teacher relationships on young people's later delinquent behavior.

The emphasis on attachments/close relationships is also at the core of Bowlby's (1973) Attachment Theory, which is one of the leading theories guiding research into interpersonal relationships and their impact on short and long-term psychosocial outcomes throughout the lifespan (Mikulincer & Shaver, 2019). It highlights the importance of parent-child interactions in shaping individuals' intrapersonal and interpersonal understanding, also referred to as "if-then" contingency beliefs (Baldwin & Sinclair, 1996). According to these beliefs, experience of negative interpersonal patterns and the expectation of rejection in the case of failure (i.e., IF I fail, THEN my father will reject me) may lead individuals to expect the same rejection in future contexts. Alternatively, experience of positive interpersonal patterns and acceptance will lead to positive future expectations or beliefs. These, with time, develop into "internal working models," or rich representational structures embodying encoded relationship experiences that later guide attention, motivation and interpretation of relational events (Bowlby, 1973). Based on these interpretations, internal working models give rise to affective experiences, emotional arousal, and behavioral responses, including antisocial behavior. For instance, if an infant cries when they are hungry and their needs are met by a sensitive and attentive parent, this experience is encoded and

informs their future behavior. They develop a sense of security and trust in others and behave accordingly. However, if the infant's needs are not met for some time, their crying may escalate, which may turn into an angry outburst. When this behavior is encoded, they will come to view the world as unsafe and may respond with antisocial behavior.

While the foundations of internal working models are laid in early childhood through interactions with caregivers, later significant experiences, such as interpersonal loss and adversity (e.g., Sabol & Pianta, 2012; Waters et al., 2000), have been found to influence attachment representations and interpersonal behavior as well. In fact, according to developmental theorists, throughout development there is a gradual displacement of caregivers as primary attachment figures (Weiss, 1982). Based on Hrdy's (2011) evolutionary theory of human development as "cooperative breeding," this displacement takes place via the process of individuation from primary caregivers which necessitates the identification and maintenance of so called allo attachments. Allo attachments are defined as strong connections to other adults, potential candidates as primary caregivers, should a child suffer a loss of a parent (Burkart et al., 2009; Kramer & Veile, 2018). Hrdy maintains that individuals tend to cultivate allo attachments throughout life as a kind of insurance policy. Indeed, she suggests that other adults (e.g., grandmothers, day-care providers, teachers) can under the right conditions—for example, frequent contact, full engagement, flexibility, and sensitivity—become more significant in a child's development than an emotionally unavailable parent.

One of the first environments in which children may have regular contact with such significant adults outside the family environment are educational establishments, such as kindergarten or school in the form of teachers. For this reason, some of the most influential allo attachments could be built from relationships with teachers who may provide the key attachment ingredients of proximity and care (e.g., Bergin & Bergin, 2009; Kesner, 2000; Rose et al., 2019; Zsolnai & Szabó, 2020). Indeed, these often temporary attachment figures may also provide a safe haven and a secure base in children's lives (Verschueren, 2015) and may even offset the negative impact of an insecure or disorganized parent-child attachment (e.g., Schuengel, 2012). Therefore, attachment theory not only provides the basis for exploring the quality of teacher-student relationships but also helps us understand the process through which these relationships may impact on child behaviors (Verschueren, 2015). Specifically, through developing a good relationship with their teacher, children foster a working model of relationships and behaviors that are prosocial and are less likely to act out or engage in delinquency.

Following on from these theories, in a previous study (Obsuth et al., 2017), we provided some of the first evidence for a potential causal impact of

teacher and student reports of teacher-student relationships by using a propensity scoring approach to estimate the long-term impact of teacher-student relationship quality on later behavior. We found that the quality of the relationship according to both informants predicted engagement in aggressive and prosocial behavior. However, the effects were most consistent and longer lasting for the student-reported quality of relationships in relation to aggressive behavior. This effect persisted up to 5 years, compared to up to 3 years based on the teacher-reported quality, following the assessment of the relationship quality.

Several longitudinal studies have identified poor teacher-child relationships as a risk factor for externalizing behavior problems in early to older childhood (e.g., Marlow et al., 2013; O'Connor et al., 2012). For example, controlling for child gender, socioeconomic status, past hostile-aggressive child behavior, and harsh-restrictive parenting, Silver et al. (2005) found that children who were rated as engaging in more conflict with their teacher in kindergarten also increasingly engaged in externalizing problem behaviors in school up to third grade. In contrast, teacher-reported closeness in the relationship with the child served as a protective factor and mitigated the escalation of problem behavior. Similar findings were reported by Pianta and Stuhlman (2004) who found that more teacher-reported conflict in the relationship with kindergarteners was related to increased externalizing problems in the first grade. Hamre and Pianta (2001) found the same effect of kindergarten-rated conflict in the teacher-child relationship up to middle school. Buyse et al. (2009) also found that children whose teachers reported that they had a more conflictual relationship with them in the first grade were rated by another teacher to be more aggressive in the second grade. Furthermore, O'Connor et al. (2012) found that teacher-child relationship quality during childhood buffered the link between insecure mother-child attachment relationships at age three and externalizing behaviors at age eight (fifth grade).

Fewer longitudinal studies have examined the role of teacher-student relationships in explaining adolescent risk taking and delinquency. For instance, a study that examined the processes linking early risk factors and risky behaviors in early adolescence, based on the NICHD Study of Early Child Care and Youth Development, found that conflict in teacher-student relationships mediated this link between early difficult temperament at age 4.5 and risky behaviors in Grades 4, 5, and 6 (up to age 12). Furthermore, closeness in teacher-student relationships was found to act as a protective factor between low family income and risky behaviors at age 12 (Rudasill et al., 2010). In a slightly older sample, based on three cohorts (age 11, 13, and 15) of the Denver Youth Study, it was found that positive teacher-child

relationships were related to fewer antisocial behaviors. This was the case over and above the effects of delinquent peers, adverse life events, and negative parenting (Tiet et al., 2010). Similar findings were reported by Theimann (2016) who found that positive teacher-student relationships in the context of positive bonds to school were related to more positive prosocial attitudes and lower rates of delinquency in young people from age 13 to 16. Wang et al. (2013) also found that positive teacher-reported teacher-student relationships moderated the impact of parent-child conflict at age 13 on changes in delinquency at ages 13 to 18. Specifically, adolescents who experienced conflict with their parents at age 13 reported fewer conduct problems, including delinquency, if their teachers reported having a positive relationship with them. On the other hand, those with a history of parental conflict, combined with negative teacher-student relationships reported the most conduct problems. In another study the authors found that negative teacher-student interactions recorded via diary assessments by adolescents at age 14 predicted their engagement in risky sexual behavior at age 15 which in turn predicted this behavior at age 17 (Kobak et al., 2012).

While the evidence of the predictive link between teacher-student relationships and externalizing problems based on longitudinal studies is consistent with a causal effect of teacher-student relationships, it does not provide direct support for causality, as it is largely based on correlational studies. The difficulties in deriving causal inferences from correlational studies have been described extensively by Jaffee et al. (2012). The authors suggested utilizing propensity analyses alongside naturally occurring "exogenous shocks" as one of the solutions (Duncan et al., 2004) or quasi-experimental variability (such as divorce vs. no divorce; incarceration vs. no incarceration) in longitudinal data. Much as in experimental designs, although through natural occurrence rather than through direct manipulation, an "intervention" occurs (e.g., getting a divorce, being incarcerated) resulting in a "treatment" group (e.g., divorced, incarcerated) and "untreated" group (e.g., those not divorced, not incarcerated). Identification of matched groups (statistically non-different) on a series of control characteristics that could theoretically explain the "intervention" (e.g., variables that may lead to divorce) and the outcomes of interest can be used to attribute the difference in the outcomes between the two groups to the "treatment," thus avoiding biases in the results due to confounding.

Following this recommendation, we utilized propensity score analyses in a previous study (Obsuth et al., 2017) in a quasi-experimental context to assess the effect of teacher-student relationships on aggressive and prosocial behavior. In that study, the "intervention" was the exposure of the youths to a new teacher in Grade 4 and the "treatment" was the quality of the

teacher-student relationship. The youths were matched with respect to 105 covariates (including their past behavior problems, anxiety depression, parenting practices, performance at school, and even the quality of their relationship with a previous teacher). That is, with respect to predictors, the only difference between the two compared groups of young people was their relationship with the teacher. The results showed that students with self-reported and teacher-reported better relationships with their teachers at age 10 reported fewer problem behaviors concurrently and up to age 15.

The Current Study

Delinquency, or minor crimes committed predominantly by minors have caused a serious societal problem worldwide for decades. During the 1980s and 1990s, the United States and countries in Western Europe experienced a sharp rise in juvenile offending (Young et al., 2017), with some countries reporting an increase in official figures of around 50% (United Nations, 2003). Yet, interestingly the ecological trends of delinquency have started decreasing in the last two decades, and this seems to be universal across most Western countries. For instance, the US reported a decrease by 3% to 5% annually with an average decrease of 34% between 2003 and 2014 (Grucza, et al., 2018). Australia reported a decrease in most offence categories for juvenile offenders between 2008/09 and 2016/17, in some cases decreases by as much as 67% (Australian Bureau of Statistics, 2021). This trend is also detectable in Western European countries, with Nordic countries reporting decreases in juvenile involvement in crime between 1992 and 2013 (Young et al., 2017). Similarly, England and Wales reported decreases in the number of children who were cautioned or sentenced, and the number of first entrants to the youth justice system between 2008/9 and 2018/19 (83% and 85%, respectively, Ministry of Justice, UK Government (2021).

Global trends are also evident in the prevalence of juvenile delinquency across different developmental stages, and there is evidence of a bell-shaped age crime curve from late childhood to early adulthood. Delinquency or the tendency to commit crime starts to rise in late childhood with a peak in middle to late adolescence (15–19 years) and then a decline in early adulthood (early 20s), and there is robust evidence that this occurs across the majority of Western countries (Loeber & Farrington, 2014). While there may be regional and country specific differences, there is clearly a global trend across Western countries regarding decreasing delinquency rates and peak age of offending. Given that all trends seem to be similar worldwide, findings from specific countries may be generalizable to others. In the current study, we focus on a longitudinal data set from Switzerland, a Western European

country that has seen similar global trends in youth delinquency over the last decades (Federal Statistical Office, 2021; Killias et al., 2004).

In order to develop effective interventions for the reduction in juvenile delinquency, it is clearly important to understand the processes that may contribute to the decrease in delinquent acts at the peak age. Supportive student–teacher relationships have been found to be one of key protective factor during this developmental period (Wang et al., 2013). Indeed, meta-analytic findings suggest the link between student–teacher relationships and behavioral outcomes is stronger for secondary than elementary school students (Roorda et al., 2011). Moreover, in line with Hirschi's (1969) tenet that social bonds indirectly impact peoples' behavior with enduring influences, it is important to explore the long-term effects of these relationships in secondary school students. With this and the effects of the age time curve in mind, examining the impact of early student-teacher relationships during early to mid/late adolescence and particularly at the peak age are clearly important.

Therefore, building on previous research and theory, in this study we evaluated the impact of the teacher-student relationships at age 10 on delinquency at ages 13, 15, and 17. We also expanded our previous research by examining the impact of these relationships on prosocial and aggressive behavior in late adolescence, at age 17. We tested both the impact of teacher-reported and student-reported relationships. This is important because the majority of previous studies have focused on one reporter, normally the teacher and multi-informant approaches have been highlighted as crucial in understanding complex psychological processes (e.g., van der Ende et al., 2012). Based on the above-mentioned literature and in line with social bonds and attachment theories we hypothesized that the young people with a better quality of teacher-student relationships at age 10 will report fewer delinquent acts throughout adolescence, up to age 17 than their matched pairs with worse teacher-student relationships. In line with Attachment Theory, which places emphasis on the young person's experience of the relationship in driving their behavior, we expected the young person reported quality of relationship to have a greater impact on young people's delinquency than the quality of the relationship reported by the teacher.

Methods

Participants

Data were drawn from the first nine waves of the Zurich project on the Social Development from Childhood to Adulthood (z-proso; https://www.jacobscenter.uzh.ch/en/research/zproso/aboutus.html); an ongoing longitudinal

cohort study that began in 2004. A sample of 56 public elementary schools was recruited, stratified by school size and socioeconomic background of the school district. The target sample at the initial assessment consisted of all 1,675 first graders from these schools (Eisner & Ribeaud, 2007).

Data were collected from teachers, students, and their parents annually in the first three waves of data collection (ages 7, 8, and 9), continued to be collected annually from the teachers up to grade 8 and again in grades 10 and 12 (ages ~7, 8, 9, 11, 12, 13, 15, 17) and bi-annually from students (ages 11, 13, 15, 17). The last data collection from parents was carried out when the students were in grade 5 (age 11). The same teacher usually teaches students from grade 1 to 3 and another one from grade 4 to 6. After grade 6 students enter a tiered system of secondary schools.

In the present study, parent-reported, teacher-reported, and student-reported data from the first three waves (ages 7, 8, 9) were utilized in the propensity score model. Teacher-reported and student-reported data collected at ages 13, 15, and 17 were examined as outcomes. In order to enable the propensity score matching (PSM) methodology, we only included students who experienced a teacher change between ages 9 and 10 (1,483 students), and for whom data were available related to the student and/or teacher-reported teacher-student relationship. This resulted in a sample size of 1,176 (49% girls) and 1,067 (49.9% girls) youths, with teacher-reported and/or student-reported relationship data, respectively. At age 7, 78% lived with both biological parents, 17.2% with only one parent, 3.8% with a biological parent and another caregiver and 1.1% with other caregivers. With respect to the educational background of the primary caregiver, 20.9% had little or no secondary education, 40.6% completed an apprenticeship, vocational school or passed A-levels, 17.3% had attended vocational high school, had a baccalaureate degree or advanced vocational diploma, and 15.2% had a university degree. For each analysis, participants were required to have a pair; each pair had to be similar on the 105 control variables and have the outcome assessments, therefore, the sample sizes for each test vary by analysis (see Tables 1 and 2).

Procedure

In line with the legal standards in Switzerland, written informed consent was obtained from the primary caregiver up to the fifth wave when their child was 11 years old. From age 13 onwards the young people provided active consent with parents remaining able to opt out their child. At ages 13, 15, and 17, the young people completed paper and pencil questionnaires outside regular school hours that lasted approximately 90 minutes. Teachers completed a

paper-and-pencil child assessment form for each participating young person.

Measures

Teacher-student relationship. Young people and their teachers reported on the quality of their relationship; these scores provided the basis for the propensity score matching. When the youths were 11 years old, they reported about their relationship with their teacher by rating the following three statements on a 4-point Likert scale from 1 (completely untrue) to 4 (completely true): "I get along with my teacher"; "The teacher is fair to me," and "The teacher supports me." Cronbach's alpha was .79. A mean score of their responses was calculated and rounded to an integer yielding a 4-point scale which was utilized in PSM. When the youths were 10 years old, their teachers responded to the following statement: "I have a good connection with this child." Responses were recorded on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). The teachers' answer to this question was utilized as a proxy for the quality of the teacher-child relationship for the purposes of this study. The questions were selected/produced by the original research team who conducted the study (see e.g., Averdijk et al., 2014).

Young person behavior. Prosocial and aggressive behaviors were measured using the Social Behavior Questionnaire (SBQ; Tremblay et al., 1991) administered to the participating youths as well as their teachers when the young people were 17 years old. The reliability and validity of the SBQ has been validated in previous research on the current sample (Murray et al., 2019) as well as other samples (Swanson et al., 2017) suggesting good validity and reliability up to age 17. This measure has been utilized in a number of longitudinal studies and has demonstrated to be sensitive to changes in behaviors in several intervention studies (e.g., Stemmler & Lösel, 2012). Previous to this study, the SBQ had been translated into German and used in Germany (e.g., Lösel et al., 2006). Both the German and English versions were utilized by professional translators to translate the measure for use in the current study in Switzerland.

The teacher subscale measuring prosocial behavior consisted of six items ($\alpha = .90$), and the aggressive behavior subscale consisted of 11 items ($\alpha = .84$). The youths' subscales measuring prosocial behavior consisted of eight items ($\alpha = .81$) and aggressive behavior was measured by nine items ($\alpha = .80$). Both the teacher and youths' aggression measures included reactive, physical, and proactive types of aggression. Each SBQ item was rated on a 5-point Likert scale ranging from 1 (never) to 5 (very often).

Delinquency and violence. At ages 13, 15, and 17, the young people completed a measure adapted from a previous large-scale survey (Wetzels et al., 2001) that included 22 items. This scale was selected as it had been used in previous studies assessing delinquency in Switzerland (e.g., Killias et al., 2004). The z-proso team added additional items in order to capture a broader range of delinquent acts. Thus, the resulting measure assessed the frequency with which the young people had engaged in 28 different acts of delinquency in the past 12 months, including stealing from home, shoplifting more, and shoplifting less 50 Swiss Franks, stealing a vehicle, driving without a license, breaking into a car/shop, drug dealing, damaging property, vandalism, threatening with a weapon, forcing sexual acts, threatening to take things, robbery, assault, the use of a variety of mind-altering substances. The dichotomous variables were combined into a total variety score by dichotomizing each item and adding up incidences. We opted for a variety score due to its lower skewness and greater reliability and validity compared with a frequency score (Sweeten, 2012). We also separated out the seriously violent behaviors at each of the three ages by adding up the incidences for carrying a weapon, robbery without a weapon, robbery with a weapon and assault.

The 105 *covariates* that were included in the ordinal logit models used to estimate balancing scores with respect to the propensity for a more positive relationship to the teacher were collected from multiple informants (child, teacher, and parent) in the first three waves (Grades 1, 2, and 3; prior to the teacher change). Each of the covariates had been identified in previous studies as having a relation to the quality of the teacher-child relationship (e.g., Drugli, 2013; Jerome et al., 2009), representing a developmental risk factor associated with child problem behavior (e.g., Silver et al., 2005) and/or facilitating prosocial behavior (e.g., Newton et al., 2014; Rodkin et al., 2013). Problem behavior measures at ages 7, 8, and 9 were included as covariates so that matching would not only be performed on child behaviors in the year before the intervention (the teacher change) but also on earlier levels of problem behavior. Six variables measured child and family characteristics (gender, parents' migration background, special needs class, parental education, socioeconomic status, and single parent home; e.g., Jaffee et al., 2012). Five variables per informant measured child behaviors and emotions (prosocial behavior, anxiety/depression, attention-deficit hyperactivity disorder, oppositional defiant disorder, and aggressive behavior; Drugli, 2013). Children and teacher reports of non-aggressive behavior problems and reactive aggression were also included. Four variables tapped parenting based on parent reports (e.g., Newton et al., 2014) and one variable assessed children's attitude toward homework (e.g., Xu, 2005). Two covariates indicated whether the child was the recipient of PATHS and/or

Triple P to control for the possible effects of the intervention that was implemented as part of the project.

Based on teacher-reported data we also included three variables related to assessing the child's school achievement (e.g., Jerome et al., 2009), a variable related to school cohesion (e.g., Thapa et al., 2013), four variables which tapped the child's social role at school (e.g., Rodkin et al., 2013), and two variables which tapped the parents' involvement in their child's school (e.g., Wyrick & Rudasill, 2009). In addition, based on child-reported data, we included four variables tapping the child's experiences of bullying victimization (e.g., Waasdorp & Bradshaw, 2011), one their bullying perpetration and one having observed bullying at school (e.g., Huang, et al., 2018; Swearer & Hymel, 2015), as well as six variables related to the child's approach to school (e.g., Huan et al., 2012). Two more variables assessed whether the children liked school and whether they got along with their peers (e.g., Peets et al., 2007).

Crucially, one variable per informant assessed the quality of the teacher-child relationship in the teacher-child dyad during the year prior to the allocation of a new teacher to the child (i.e., in grade 3). This means that matching, if successful, balances the treated and untreated on the quality of the teacher-child relationship with the previous teacher. For details related to the specific measures please see Obsuth et al. (2017).

Analytical Procedure

We utilized the *optimal non-bipartite PSM technique* (Lu et al., 2011) to identify matched pairs of children. This matching technique yields pairs of participants who are as different as possible in their dose of the treatment (less vs. more positive relationship with their teachers according to the students' point of view, and also according to the teacher's point of view), while at the same time they are as similar as possible on potentially confounding characteristics, the covariates. We ran the ordinal logit model that relates the teacher-child relationship to the 105 covariates and derived the propensity score that is used subsequently in the matching (see previous study Obsuth et al., 2017). We applied a caliper to the matching, that is, we required matched pairs to be within 0.15 standard deviations of the (balancing) propensity score (Snodgrasse et al., 2011). This matching algorithm yielded 284 matched pairs for the young person-reported relationship and 383 matched pairs for the teacher-reported data. That is, it identified dyads of youths, in which one young person reported or was reported to have a more "positive" relationship with their teacher and the other a less "positive" relationship, while being similar with respect to the 105 covariates.

After the matching, we carried out a set of matched sample *t*-tests and standardized mean difference (|SMD|<0.20) statistics recommended by Rosenbaum and Rubin (1985; Snodgrasse et al., 2011) to assess the balance for each covariate. The matching was successful as both the *t*-statistic and SMD indicated no significant differences between the two groups based on the 105 pre-treatment (or pre-teacher change) characteristics, which were included to calculate the balancing score.

We further carried out a set of X^2 and *t* tests to examine whether the young people who were matched based on the teacher-student relationship were different from the rest of the total sample on a set of demographic variables as well as prosociality and aggression at baseline (at age 7). These analyses revealed no significant differences between the two groups based on the self-reports. However, teacher reports at age 7 suggested that those who were matched were more prosocial ($t=-3.92$, $p<.001$), less aggressive ($t=2.59$, $p=.010$), and less oppositional ($t=2.55$, $p=.011$) than those who did not match.

Finally, we utilized paired samples *t*-tests to assess the differences in outcomes in the matched pairs of "treated" (less positive teacher-child relationship than the one of the matched child) versus "untreated" (more positive teacher-child relationship than the one of the matched child), based on both student-reported and teacher-reported relationships. For more information about the study and analytical procedure and sample, please see previous work (e.g., Obsuth et al., 2017).

Results

Descriptive Statistics

Of the 1,067 youths who provided information about their relationship to their teacher, 608 (57.0%) reported as having a good relationship with their teacher, 384 (36.0%) reported as having a somewhat good relationship, 64 (6.0%) reported as having a somewhat poor relationship, and 11 (1.0%) reported as having a poor relationship with their teacher. Of the 1,060 teachers who provided information about their connection with each student, 353 (21%) reported that it was completely true they were close, 443 (26.4%), 202 (12.1%) true, 58 (3.5%) somewhat true, and 5 (0.3%) reported that this was not true. The correlation between the teacher-reported ($M=4.062$, $SD=0.879$) and child-reported ($M=3.489$, $SD=0.657$) quality of the teacher-student relationship was .17, which was significant at $p<.0001$. Means and standard deviations of outcome variables are reported in Table 1 for the youth reported relationship and Table 2 for the teacher reported relationship.

Youth-Reported Teacher-Student Relationship

The effect of teacher-student relationships at age 10 on delinquency at ages 13, 15, and 17. Consistent with our hypotheses, young people who at age 10 self-reported a better relationship with their teachers reported engaging in significantly fewer different acts of delinquency at ages 13, 15, and 17. At age 17, they also reported engaging in significantly fewer violent behaviors (see Table 1).

The effect of teacher-student relationships at age 10 on aggressive and prosocial behavior at age 17. Consistent with our hypothesis and our previous findings, young people who at age 10 self-reported a better relationship with their teachers self-reported significantly less aggression at age 17. The findings related to prosociality reported by the youth or teachers were not statistically significant. Teacher-reported aggression also did not yield statically significant results (see Table 1).

Teacher-Reported Teacher-Student Relationship

The effect of teacher-student relationships at age 10 on delinquency at ages 13, 15, and 17. With respect to teacher-reported delinquency and teacher-student relationships, none of the findings were statistically significant (see Table 2).

The effect of teacher-student relationships at age 10 on aggressive and prosocial behavior at age 17. There was no significant effect of age 10 teacher-reported teacher-student relationship on self-reported aggression and prosociality at age 17, nor on teacher-reported aggression at age 17. However, counter to our hypothesis, according to the teacher reports at age 17, the young people who had worse teacher-reported teacher-student relationships at age 10 were significantly less prosocial than their counterparts with a worse teacher-reported relationship at age 10 (see Table 2).

Discussion

Extensive empirical evidence supports the link between positive adult-child relationships and a range of social, emotional, cognitive, and behavioral outcomes. There is a widely accepted and long-standing consensus among developmental theorists and researchers that positive relationships with others are key to ensuring healthy development and prevent maladaptive behaviors (e.g., Cicchetti, 1989; Rutter, 1971). According to a working paper

Table 1. Matched Pairs Based on Child Reported Teacher-Student Relationship at Age 10 and Outcomes at Ages 13, 15, and 17.

Age (*n*)	Outcome	Better rel. (*M*/*SD*)	Worse rel. (*M*/*SD*)	Paired samples *t*-test (*p* value)
Age 13 (208)	Delinquency	5.296/3.907	6.592/4.539	3.308 (<.001)
	Violent behavior	0.183/0.569	0.247/0.497	1.227 (ns)
Age 15 (235)	Delinquency	7.394/3.984	8.584/4.466	3.244 (<.001)
	Violent behavior	0.207/0.566	0.248/0.628	0.759 (ns)
Age 17 (194)	Delinquency	7.193/3.412	7.973/3.882	2.008 (.043)
	Violent behavior	0.036/0.186	0.113/0.377	2.572 (.011)
Age 17 (195)	Prosociality (self-report)	3.722/0.603	3.710/0.603	−0.181 (ns)
	Aggression (self-report)	1.518/0.424	1.617/0.477	2.02 (.044)
Age 17 (86)	Prosociality (teacher-report)	2.166/0.845	2.055/0.845	−0.903 (ns)
	Aggression (teacher-report)	0.114/0.223	0.152/0.296	0.932 (ns)

Table 2. Matched Pairs Based on Teacher Reported Teacher-Student Relationship at Age 10 and Outcomes at Ages 13, 15, and 17.

Age (*n*)	Outcome	Better rel. (*M*/*SD*)	Worse rel. (*M*/*SD*)	Paired samples *t*-test (*p* value)
Age 13 (265)	Delinquency	5.519/4.289	6.080/4.536	1.481 (ns)
	Violent behavior	0.236/0.558	0.227/0.630	0.174 (ns)
Age 15 (300)	Delinquency	7.601/4.354	8.015/4.498	1.086 (ns)
	Violent behavior	0.209/0.561	0.251/0.646	0.830 (ns)
Age 17 (115)	Delinquency	7.676/4.129	7.843/3.489	0.328 (ns)
	Violent behavior	0.130/0.408	0.052/0.223	−1.747 (ns)
Age 17 (253)	Prosociality (self-report)	3.706/0.616	3.705/0.577	−0.012 (ns)
	Aggression (self-report)	1.544/0.457	1.600/0.484	1.398 (ns)
Age 17 (120)	Prosociality (teacher-report)	1.916/0.845	2.127/0.771	2.122 (.036)
	Aggression (teacher-report)	0.164/0.258	0.147/0.289	−0.508 (ns)

published by Harvard's National Scientific Council on the Developing Child (2015), based on a review of the existing evidence, children who thrive even in the context of serious adversity "have had at least one stable and committed relationship with a supportive adult." While parent-child relationships have been at the forefront of this research, in the last two decades research has highlighted the importance of the quality of relationships with other familial and non-familial adults in authority positions, such as teachers (e.g., O'Connor et al., 2012; Rudasill et al., 2010). In line with this, several studies have found links between positive teacher-student relationships and a range of positive outcomes. However, given the nature of these correlational studies, it has been difficult to ascertain whether these represent causal effects.

In this paper, we utilized propensity score matching in a quasi-experimental context to approximate this causal link. As predicted, we found that young people who reported to have a better relationship with their teacher at age 10 reported to engage in fewer delinquent acts at ages 13, 15, and also 17. At age 17 they also reported to engage in fewer violent behaviors. Also consistent with our previous findings (Obsuth et al., 2017) at ages 11, 13, and 15 these youths also reported to be less aggressive at age 17. These findings are consistent with the handful of previous studies (Kobak et al., 2012; Wang et al., 2013) that point to the protective function of teacher-student relationships with respect to future antisocial behavior. Our findings expand on these findings in important ways.

Specifically, our findings highlight positive teacher-student relationships as a causal protective factor against externalizing behavior problems—aggression and delinquency—up to 7 years following the assessment of the relationship. As such our findings provide strong support for the role of teachers in the lives of young people as suggested by developmental researchers and theorists and criminologists alike. For example, according to both Social Bond Theory (Hirschi, 1969) and Attachment Theory (Bowlby, 1997), warm and supportive relationships between children and caring adults are crucial for advantageous developmental outcomes (e.g., Sabol & Pianta, 2012; Verschueren & Koomen, 2012) and refraining from delinquency (e.g., Cassino & Rogers, 2016). Thus, while a teacher's primary role is to impart knowledge on their pupils, it is recognized that their impact is far broader. When teachers approach students with openness, warmth, care, and respect, the students feel supported and close to their teachers. In these cases, the teachers' views and expectations become important to the students and may serve as a deterrent from delinquency. The impact of teachers on the socio-emotional development of young people is far reaching and long-lasting (Verschueren & Koomen, 2012). Indeed, in our study we observed these effects as long as 7 years later.

Notably, significant differences were not observed when examining prosocial behavior at age 17 based on the self-reported quality of the teacher-student relationship. Upon reflection, this may not be a completely surprising finding. One has to learn how to act in a prosocial way as this requires specific skills. That is while feeling supported and like one is getting along with the teacher may facilitate students refraining from antisocial behaviors, proactively engaging in specific behaviors may require a more active involvement/ influence. Prosocial skills have been shown to be learned through interactions with others, both peers and adults. For example, when teachers are trained to provide dialogic learning environments in which meaningful interactions between students around specific topics are facilitated by teachers, this has been related to increases in students' prosocial behaviors (Villardón-Gallego et al., 2018).

In contrast to the youth-reported relationship effects, no significant differences were observed in relation to aggression or delinquency in the pairs of young people who were matched based on their teacher's report of the quality of the relationship with them. Consistent with our hypothesis, these findings suggest that the young people's perspective on the quality of their relationship with their teachers is of greater significance than the perspective of their teacher on their relationship. Notably, we do not know whether the young people are better judges of the relationship or whether this perception is, or needs to be, based on an objectively observable better (i.e., more supportive, warm) relationship to result in these outcomes. However, in the end what seems to matter most is the young people's perception of the relationship in predicting fewer future negative outcomes up to 7 years later. In fact, these findings are consistent with attachment theory, which up to adulthood is described to be a dyadic but unidirectional relationship, in which the child is the care seeker and the adult the care giver (e.g., Hazan & Shaver, 1987). Given that it is the young person who is in the position of care/support seeking, it makes sense that it would be their perception of the quality of care they receive rather than the adult's/teacher's perception of the care they provide that would be a stronger predictor of their behavior. Consistent with this interpretation, according to both Hirschi's (1969) Social Bond Theory and Social Motivational Theory (e.g., Furrer & Skinner, 2003), the students own perception of their relationship with their teacher as accepting and supportive, whether congruent with other sources of information or not, is key to achieving greater liking for and attachment to their school; thus in turn better school performance and behavior (Social Motivation Theory) and resistance from offending/delinquent behavior (Social Bonds Theory). These findings are also consistent with our findings in the first study (Obsuth et al., 2017) and underline the importance of obtaining a multi-informant perspective in

studies of teacher-student relationships and particularly in ensuring that the young person's perspective is represented.

Another possible explanation for the discrepancy between the results based on teacher- versus student-relationship quality is that young people and teachers may value different aspects about the teacher-student relationships. The handful of studies (Gest et al., 2005; Hughes et al., 1999; Rey et al., 2007) that explored teacher-student relationships from the young people's as well as teachers' perspective around age 10 (from age 8 to 11), reported correlations of .16 to .25 between the two informants. One study (Kavenagh et al., 2012) found that adolescent boys (mean age 13.10) and their teachers viewed their relationship generally positively; however, with relatively low concordance (44% were mismatched). Furthermore, while boys saw caring and helpful attitudes toward them alongside positive feedback as key to positive relationships with their teachers, teachers viewed youths' help-seeking as key for defining the quality of their relationship.

Yet another explanation of the discrepancy may lie in the possibility that student-perceived and teacher-perceived better relationships with teachers are related to different outcomes. Indeed, a study by Hughes (2011) found that teacher-reported quality of relationships uniquely predicted academic competence and young person-reported quality of relationships predicted school belonging and maths achievement in second and third graders. Differential effects of teacher or child reported teacher-child relationships were also reported in kindergarteners (Murray et al., 2008), with students and teachers reporting minimal agreement on a range of measures related to students' perceptions of teacher support. The authors acknowledged that whilst they attempted to tap into the same constructs with the measures they utilized for each informant, it was possible that either students and teachers provided different information about the constructs, or that they perceived their relationships differently. Indeed, in the case of our study, the quality of the relationship reported by the teacher and students was assessed by tapping into different aspects of the relationship. This in itself could have been linked to the differential findings. Multi-informant approaches are described to be preferable precisely due to providing often discrepant and thus richer findings elucidating complexities in human functioning (e.g., van der Ende et al., 2012). Exploring these differences in adolescent samples may be an important next step to further build on our findings.

In the present study, there was only one significant effect of teacher-reported teacher-student relationship. This was in an unexpected direction and suggested that those young people who at age 10 were reported by their teachers to have a better relationship with them were observed by their teachers at age 17 to be less prosocial. Notably, teachers were only asked one

question that assessed their sense of connectedness to that particular child. Moreover, they were rating their level of connectedness with all of the children in the classroom who participated in the study. It is therefore possible that teachers were rating their connectedness with each student, at least to some degree, based on how much time they spent with them, or some other characteristic that may require more of their attention, but which is not necessarily related to their prosociality. Importantly, while we matched the students on 105 individual, family and school variables, we were unable to match them on any teacher characteristics as such data were not gathered. Previous research has shown that teacher characteristics, such as stress (e.g., Yoon, 2002), general wellbeing (e.g., Gu & Day, 2007) and job satisfaction (e.g., Veldman et al., 2013) may influence their relationship with students or their perception of their relationship with them. It is therefore possible that some or all of these factors played a role in teachers' perceptions and ratings of their relationship with the students. Others (e.g., Verschueren & Kooman, 2012) have highlighted teacher characteristics such as teacher sensitivity to children's needs as a key aspect defining teacher-student relationships. Thus, the assessment of different teacher characteristics represents an exciting future direction for research that may shed more light on aspects of and contributors to high quality teacher-student relationships.

It is important to consider the limitations of the current study and related further future research. First, for the current study we utilized a rich existing longitudinal data set that afforded us the opportunity to match the young people on a range of relevant measures and also look at their longitudinal outcomes. However, this meant that we also relied on the available information related to the assessment of the quality of the teacher-student relationships from the students' and teachers' perspective, which comprised three and one question, respectively. Thus while our findings provide important evidence related to the potentially causal links between teachers-student relationships and delinquency/aggression up to age 17, these findings will need to be replicated utilizing widely used measures of these relationships (e.g., the Student-Teacher Relationship Scale; TSRS, Pianta & Steinberg, 1992). However, it should also be noted that few well validated measures of teacher-student relationships are currently available. Most studies utilize the TSRS for both teacher-reported and student-reported quality of relationships (far fewer studies in the case of the latter) and tap into only two specific aspects of the relationship—closeness and conflict. It may be important to develop new measures of these relationships, particularly to tap into the students' views and what is important for them in a "good relationship" with a teacher. Second, the possibility always remains that despite the large number of covariates (105) that we used in the matching process there are additional

unmeasured confounds impacting results. For instance, a recent review of juvenile delinquency (Kennedy et al., 2020) has identified a set of different neighborhood characteristics as additional risk and protective factors. In our study we did not account for any neighborhood characteristic, thus their influence should be explored in future research. Furthermore, future research that examines the impact of interventions on teacher-student relationships on child behavioral outcomes will be valuable in providing further evidence to assess whether the robust correlational effect of teacher-student relationships is causal. Furthermore, in this study we did not address the processes that facilitate the link between teacher-student relationships and behavioral outcomes. It is possible that these relationships contribute to students' engagement in fewer antisocial behaviors through increasing their self-esteem, sense of emotional security, or decreasing their antisocial attitudes or anger. These and other potential mechanisms (mediators) need to be explored to inform mechanisms of change in intervention practices targeting teacher-student relationships.

Despite these considerations, our study also represents a significant contribution to the understanding of the impact of the quality of teacher-student relationships on antisocial behaviors, given its notable strengths. Specifically, we drew on a large representative sample with a wide range of available data spanning 9 years of the young people's lives, including a naturally occurring teacher change. This allowed us to apply a propensity score matching counterfactual approach offering inferential benefits similar to those of a randomized controlled trial but based on ecologically valid data. Accordingly, we are in a better position to conclude that the quality of teacher-student relationships as perceived by the students has a causal impact on delinquency, violent behavior and aggression up to 7 years later. Finally, we utilized a non-bipartite matching approach, in contrast to a "treatment" approach based on a binary variable. This allowed us to utilize the full scales and extent of the quality of the teacher-student relationships recorded by the teachers and students.

Conclusion

Our findings build on previous studies that suggest that relationships with teachers play an important role in children's developmental outcomes by providing evidence consistent with the claim that these impacts are causal. Our results extend these findings by demonstrating important effects of these relationships up to adolescence and with respect to aggression and serious behavior problems—engaging in delinquency. They further highlight that it is the young person's perception of the relationship that is most important. This is

an important consideration given that the majority of studies that examine the role of teacher-student relationships in young people's development rely on teachers' points of view only. Our findings suggest that training programs and interventions focusing on enhancing teacher-student relationships may focus on training teachers to interact with their students in ways that would foster the students' sense of being supported and understandood by their teachers. However, in light of our findings, an important next step may be to establish what specific teacher behaviors are perceived by the students as contributing to more positive teacher-student relationships. Furthermore, by encouraging teachers to engage in those behaviors as well as in reflective practice (Sellars, 2017) they would be better able to recognize aspects of the relationships that are perceived by the students in a positive way and lead to positive developmental outcomes.

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Author Biographies

Ingrid Obsuth's academic interests are in the area of adolescent mental health with a focus on attachment relationships, family conflict, adverse childhood experiences, and behavior problems. Her research centers around three main topics: (1) exploring the socio-emotional, cognitive, and biological aspects of the development and progression of behavior problems in children and adolescents; (2) the development and evaluation of prevention and intervention programs for children and youth; and (3) the development of reliable techniques to assess socio-emotional functioning in children and adolescents.

Aja Louise Murray primary research interests relate to developmental aspects of mental health phenotypes and their comorbidity. She has a particular interest in ADHD, autism, and conduct problems. She also research quantitative methodology, especially psychometrics and longitudinal methods. Current projects include the Evidence for Better Lives Study: https://www.vrc.crim.cam.ac.uk/vrcresearch/EBLS

and collaborations with the Zurich Project on Social Development from Childhood to Adulthood: https://www.jacobscenter.uzh.ch/en/research/zproso/aboutus.html

Monja Knoll's research interests center around emotional and linguistic development across a wide range of lifespan stages, particularly in populations in which such development may be vulnerable to negative factors. Her main focus has been on investigating the emotional and linguistic functions of caregiver speech between caregivers and infants, and how such interactions affect later social-emotional outcomes. She has also examined acoustic adaptations in speech directed at other groups that may be in need of linguistic and emotional modifications, with a view to determine how such modifications in these interactions affect the listener and may be improved in a variety of different settings with training (e.g., young people in care, hearing impaired people, teacher-student interactions, people living with Parkinson disorder, or dementia).

Denis Ribeaud's research interests include human development and aggressive behavior, experimental research on violence prevention, and indicators and secular trends of youth violence. Since 2003 he has been working as the scientific coordinator of the Zurich Project on the Social Development from Childhood to Adulthood (z-proso), which he has been co-leading since 2011. z-proso examines the life course development of violence and other problem behavior by means of repeated surveys in a sample of more than 1,300 youths.

Manuel Eisner's academic work revolves around the explanation of the causes, the consequences and the prevention of interpersonal violence across human societies. His research tries to contribute to the following questions: How can we describe and explain variation in levels of violence between societies and over the course of human history? What psychological and social mechanisms account for change and stability of violent behavior over the life course? What combination of prevention, intervention, and control is best suited to reduce interpersonal violence in different societies across the world? You can visit https://www.vrc.crim.cam.ac.uk/vrcresearch to find out more about his research projects.